From glowbugs@theporch.com Thu Sep 19 02:41:40 1996
Return-Path: <glowbugs@theporch.com>
Received: from uro (localhost.theporch.com [127.0.0.1]) by uro.theporch.com
(8.8.Beta.5/AUX-3.1.1) with SMTP id CAA05628; Thu, 19 Sep 1996 02:34:46 -0500
(CDT)
Date: Thu, 19 Sep 1996 02:34:46 -0500 (CDT)
Message-Id: <199609190734.CAA05628@uro.theporch.com>
Errors-To: ws4s@midtenn.net
Reply-To: glowbugs@theporch.com
Originator: glowbugs@theporch.com
Sender: glowbugs@theporch.com
Precedence: bulk
From: glowbugs@theporch.com
To: Multiple recipients of list <glowbugs@theporch.com>
Subject: GLOWBUGS digest 295
X-Listprocessor-Version: 6.0c -- ListProcessor by Anastasios Kotsikonas
X-Comment: Please send list server requests to listproc@theporch.com
Status: O

GLOWBUGS Digest 295

Topics covered in this issue include:

Date: Wed, 18 Sep 1996 08:43:15 -0700
From: jeffd@coriolis.com (Jeff Duntemann)
To: glowbugs@theporch.com
Subject: Space charge tubes, cheap!

Message-ID: <1.5.4.32.19960918084041.00ebf6f8@ntserver.coriolis.com>

Hi guys--

I've been fascinated by the space charge effect for a couple of years, because it allows us to give kids the means to build one-tube radios that don't involve lethal voltages or unobtainable B batteries. A simple and cheap 12V wall wart should do the trick. I hadn't thought of using the space charge effect with ordinary tubes like the 49 (as mentioned in the description of the Hiker's Regen) because there is a whole family of modern space charge tubes from the midlate Fifties, created to allow car radios that run on 12V, eliminating the vibrator supply. These tubes were created in vast quantities for a market that vanished in the early Sixties, and without any other major use, they sat on shelves in huge numbers. ARS sells them for a buck or two, NOS.

I tinkered with a regen circuit using a dual triode (12U7 I think) but I never got it to work well. I never thought of trying a tetrode, but they're available and I may even have a couple.

My usual problem of not having my tech library here at work keeps me from citing a few numbers, (and I have no Net access at home) but I'll look some up tonight and post the numbers here, along with Lindsay's address for the coil winder book.

In the meantime, I'd be curious to hear stories of people who have used 12V tubes successfully. I do know the 12AX7 can be used at 12V for things like converters; I have articles about that in my files out of CQ and QST. I made the 12U7 oscillate at 12V without any trouble. A good, sensitive regen detector eluded me--but to be fair I didn't spend a lot of time on it.

--73--

--Jeff Duntemann KG7JF
  Scottsdale, Arizona

Date: Wed, 18 Sep 1996 12:58:24 -0400 (EDT)
From: rdkeys@csemail.cropsci.ncsu.edu
To: glowbugs@theporch.com
Cc: rdkeys@csemail.cropsci.ncsu.edu ()
Subject: HomeBrew RF Chokes.... Continued.
Message-ID: <9609181658.AA100265@csemail.cropsci.ncsu.edu>

Whilst twiddlin' the grey matters fer thoughts on homebrewed RF chokes, I decided to go back and review some of my early handbooks and see what was

there.

1. From Elmer Bucher's Practical Wireless Telegrahpy (1917):

    ``These coils consist of a few turns of fine wire wound in the form of a spiral, or in a single layer on a porcelain, glass or hard rubber tube. They offer but little impedance to the low frequency current flowing from the secondary winding of the transformer, but they greatly impede the radio-frequency oscillations. Hence the secondary winding is protected from injury.''

This relates to transformer driven spark transmitters. But, the concept of a spiral winding is interesting. The chokes keep the spark RF out of the line transformer.

2. From Loomis' Radio Theory and Operating (1925), paragraph no. 335:

    ``The radio frequency choke coils used in tube transmitters have usually an inductance of about 3 millihenries, and are made of one layer of insulated copper wire, No. 28 or 30, wound over an insulating bas about 2 inches in diameter and 7 or 8 inches long.''

That is a pretty big choke coil!

3. From 1928 ARRL Handbook, page 80 (relating to a ``simple and inexpensive low-power sending set'':

    ``The radio-frequency choke coil (at left) is wound of about 150 turns of No. 30 D.C.C. magnet wire on the cardboard tube for 1-1/2 inch in diameter and held in place by the connecting bus wiring.''

This appears to be a 160 meter transmitter. So, 150 turns on a toilet paper roll form should do the trick. Perhaps a little wax or shellac to seal it up to prevent turns from shifting.

34 From 1928 ARRL Handbook, page 88 (relating to RF Chokes in general):

    ``In a quarter-wave choke the voltage at the end next the transmitter is highest (loop) while at the power supply end the voltage is minimum or zero (node). The size wire used should be slightly larger than necessary to carry the plate current as otherwise the R.F. present may burn the choke up. Building the choke to dissipate the heat generated in the windings is a more difficult problem when the cooke is confined instead of mounted in the open where the heat radiation is good. A quarter wave choke for 40-meter work will be a half-wave choke for

20-meters. This may be checked with a Westinghouse Spark-C or any form of neon-lamp indicator. A screwdriver or other metal object with an insulated handle may be used for making an investigation of conditions. The size of a quarter-wave choke should be varied until there is no spark (or an extremely small one) at the power supply end.''

So, the best operation seems to be with a quarter wave choke, just as a quarter wave impedance transformer. But, BE EXTREMELY CAREFUL OR DONT USE the screwdriver method to test for proper choking action. You might get zapped by the High Voltage. The neon-indicator is probably a much safer method. We don't want any boatanchorites or glowbuggites getting zapped to SK status, OK!

5. From 1928 ARRL Handbook, Page 88 (again on RF Chokes in general):

``Satisfactory chokes can be wound for a low-power job using No. 30 wire closely wound on a 3-inch form, 250 turns for 150-200 meters, 150 turns for 75-80 meters, 100 turns for 40 meters, or 50 turns for 20 meters. ''

This is for a 3 inch coil. If you reduce the size of the coil form, then more turns are going to be required. How much may require some cut and try or coil inductance calculations. The 3-inch for required many fewer turns than the 1 inch forms I hinted at yesterday.

Continuing on:

``Smaller diameter coils are preferable to confine the field to the coil and to reduce the voltage per turn (which causes breakdown when excessive). Of course smaller diameter choke coils must have a correspondingly greater number of turns.''

So, it would appear that a smaller diameter form could be advantageous both in stray RF coupling and in insulation breakdown at higher plate voltages.

Continuing on:

``R.F. chokes to go in series with the grid leak should be made to the same specirications as the plate choke for a given set. The choke should always go at the tube-end of the leak or right next the plate if we are referring to a parallel-feed Hartley circuit.''

Grid leaks were often choked to prevent excessive rf coupling feedback. So, the choke goes right next to the tube and should be the same size as the normal plate choke. Also, for parallel-feed circuits, place the choke as close to the tube plate pin as possible. All this is obvious,

right?

6. From 1928 ARRL Handbook, page 92 (concerning transmitter adjustment):

> ``Sometimes trouble will be found with the radio-frequency choke coil or coils. When working below 20 meters wavelength*, chokes in series with the filament leads will help to get more antenna output. Often chokes in the 110-volt power supply leads to the station will be helpful in preventing loss of radio-frequency energy. R.F. chokes so used give the high frequency impulses a backstop `on which to get their feet placed.' Chokes in the set should be mounted at right angles to the main coil to avoid harmful coupling effects. There is bound to be some coupling if the coils are near together even if they are located at right angles. A greater distance will aid materially in improving the operation or if this is impossible, the position may be changed until the right point of lowest coupling is found.''

So if you are working 20/10/5 meters, you need to use chokes in the filament leads. On lower frequencies this probably would be a pretty good idea also. The part about using 110v line feed RF chokes is a good one, especially if one is building breadboard style sets. Modern all aluminum shielding helps too.

Note that sometimes the placement of the choke is important, and that classical right angling of the chokes and coils helps to prevent stray rf coupling. How many of us follow that technique to the letter?

So, by 1928, homebrew chokes were beginning to favor single-layer solenoid wound chokes. That is probably a pretty good idea, although in tight construction, room for such large chokes is often not available. Thus modern pie wound chokes would fill the bill there.

7. From Ghirardi's Radio Physics Course (1960 reprint), nothing is mentioned about RF chokes, or their construction, other than a few indications of some many mh required at for such a choking use. Chapter 23 is a good general chapter on coils and their design (pp 586-614).

78 From Duncan and Drew's Radio Telegraphy and Telephony (1931), page 672:

> ``It will be noted that the radio-frequency chokes are not single-layer wound coils, but have a special form of winding. This construction was found necessary in order to prevent trouble due to burned-out chokes. The burning currents were frequencies of some even multiple of the fundamental or operating frequency of the transmitter. Because of the

special winding the chokes possess a greater amount of inductance and less distributed capacitance than the ordinary single-layer wound coil. Damage to these special chokes could only be done by frequencies other than those that might possibly be generated in the circuits in which they are contained.''

This refers mainly to plate chokes, but it is interesting that by 1931, commercial marine radio transmitters (about which this chapter in the book was written) were using pie-wound chokes rather than single-layer chokes for the above reasons. It is interesting that the burning seems to be due to harmonic or perhaps parasitic oscillations.

Continuing on, relating to grid radio-frequency chokes:

> ``A grid radio-frequency choke prevents losses through the grid circuit of the high frequencies which flow from the grid excitation condenser. The largest amount of this energy fed back from the plate circuit is necessary for building up a maximum alternating current voltage on the grids to promote the generation of continuous oscillations. Also, the grid choke coil will suppress ultra high frequency or parasitic oscillations from being generated. The frequency of such oscillations, if allowed to occur, is governed mainly by the grid to plate capacity of the two tubes in series and the inductance of the connecting leads.''

So, for better oscillations in the oscillator, use a grid choke. Also, the grid choke can suppress parasitics in amplifiers. Obvious, right? How many of us think to use grid chokes?

9. By the 1936 ARRL Handbook, everyone seemed to be using commercially made RF chokes.

That is all I could lay my hand on, right off, but might serve as starting material for folks trying to build their own homebrew transmitter rf chokes.

73/ZUT DE NA4G/Bob

Date: Wed, 18 Sep 1996 14:15:56 -0400 (EDT)
From: rdkeys@csemail.cropsci.ncsu.edu
To: glowbugs@theporch.com, boatanchors@theporch.com
Cc: rdkeys@csemail.cropsci.ncsu.edu ()
Subject: Special BA/GB OT Net funzies
Message-ID: <9609181816.AA100425@csemail.cropsci.ncsu.edu>

In addition to the usual QTR/QRG for the BA/GB ``net'' (roundtable),

QTR 0100Z QRG 7050 KHZ (any BA/GB rig)
QTR 0200Z QRG 3579R545 KHZ (any BA/GB rig)
QTR 0300Z QRG 1802R500 KHZ (any BA/GB rig),

I am proposing the following special get-together for those of use than can muster up something v-e-r-y ancient, indeed, like PRE-WWII ham gear (mostly for the 1 tuber rockbound or Hartley/Colpitts/TNT/TPTG with regenerator receiver crowd):

QTR 0400Z QRG 3579R545 KHZ (pre-WWII ancient bottleburners only).

This will be a time and place to try your favorite regen sets and genuine self-heating firebottle OT rigs. All you lurkers that have been working on a fine breadboard rig, or a little single bottle 6L6 thingie are most welcome. Lurkers are welcome for DX and RST reports to help the OT rigs be more properly adjusted and let the folks know how well they get out. This is where the peanut whistles and teensie-weensies babybottle burners can get a chance to breathe some ether AFTER W1AW and the bigboys nets have gone to bed for the night.

If there is any interest, let me know. Pass the word and lets see if anything falls out of the woodwork, or decides to show up on the QRG and peanut whistle a micromicrohole in the ether.

Remember folks, these ``nets'' (roundtables, actually) are for your boatanchoring and glowbugging pleasure (as well as mine). If you can make it or have an interest, do join in. Even rice boxes are permitted if you are unable to get yer bottleburners stoked up. Don't depend upon me to try to call an official ``net'' of sorts, but whoever gets there first, call the round and see who is there. Don't be timid. Don't worry if your QRQ is only 10 wpm and a tad shaky and rusty. Even us Olde CW Pfartes need a liesurely QRS armchair breather from them thar High-Speed Henriettas wats abounds wid them thar computerischeskeyboarden maschinen.

73/ZUT DE NA4G/Bob UP

Date: Wed, 18 Sep 1996 18:34:05 -0500 (CDT)
From: Chris Broadbent <cfb@bga.com>
To: glowbugs@theporch.com
Subject: Advice on tube cutoff frequency.
Message-ID: <199609182334.SAA13630@zoom.bga.com>

Hi again,

I've been quiet for a little while - working on my 6LR8 based CW TX. I have run into a problem that I believe may make this tube a bad choice for 40M.

The TX is built and working, more or less. It is based on the circuit in the book, "Complete Guide to Amateur Radio", by Joseph DuBovy. BTW, to the gentleman who's collating names of books with circuits, I'll send the information to you when I'm done, including all caveats. Of course, if you want just the book data now, the book's ISBN is 0-13-159798-1, published in 1979, 3rd printing by Reward Books (1987). The circuit is on pages 195 thru 204. However, see below.

A couple of serious caveats are in order, though. Some of the component choices in the book are not right. For example, there is a bleeder resistor across the power supply output. At 47K with 280V, the specified 1W resistor is quite underrated for the roughly 1.6W it actually dissipates.

Secondly, and this is where I need some advice/confirmation, while it seems to work OK on 80M, on 40M it does not emit at all well. I have unloaded the tube output from the pi tank for some measurements, just to minimise the chance that I'm sinking the energy there. At 3.7Mhz, I get about 16V p-p out from the triode oscillator - at 7.1Mhz, about 8V p-p. When keying (grounding the pentode's cathode), I get about 250V p-p at the unloaded pentode plate, about 55V p-p at 7.1Mhz. In fact, if I key too long at 7.1MHz, in the dark I see just the very beginnings of a deep, deep red glow along a strip of the plate (with or without the pi tank & dummy load) - a bad thing if I understand this correctly. These measurements mirror the performance I'm getting with tank and dummy load connected.

My RCA data book gives me no information on maximum or cutoff frequencies for the 6LR8, but given how the triode and the pentode stages seem to exhibit the same degree of attenuation at the higher frequency, I believe 40M may be too high for said tube. Can anyone confirm or deny this? BTW, the book doesn't give any electrode capacitance numbers for the tube.

Another thing - even at 80M, I am not getting anywhere near 50W. Some of this is probably due to it running at less than the maximum supply voltage (280V - the book listed 200V-400V as the supply range). But at about 15W out, I'm not sure if the remainder would be made up with the extra supply. Of course, perhaps I have a problem somewhere, but I don't think I have any parasitic oscillations anywhere (unless they're at such a frequency that I can't see them on my scope). Likewise, I don't have any arcing or shorting anywhere (I don't think!). BTW, the tube's maximum recommended plate voltage is 400V - I would be nervous about running it right on the edge like that.

In an effort to increase power, I have reduced the triode plate resistor to beef up it's output (triode plate signal dips less when pentode is keyed)

and I put a 2.2mH choke in series with the pentode signal grid 27K grounding resistor (output increased by about 10%). Of course, I am keeping an eye on the tube's maximum ratings.

Any advice anyone could give me will be welcome. Has anyone else built this actual device? If so, how did it go?

Do not misunderstand, I am neither discouraged, nor depressed - I have learned a lot thus far. In fact, with the problems I'm having, it's been a bit of a deep end experience. If I end up with a 15W 80M only rig, I'll still be happy. I'll just have to come up with a design for a more powerful tube based 40M rig as my next project!

Lastly, my nice, fresh call letters are KC5VQL.

Cheers,

--

Chris F. Broadbent

Date: Wed, 18 Sep 1996 17:13:45 -0700
From: jeffd@coriolis.com (Jeff Duntemann)
To: cfb@bga.com
Cc: glowbugs@theporch.com
Subject: Re: Advice on tube cutoff frequency.
Message-ID: <1.5.4.32.19960918171109.00ebba08@ntserver.coriolis.com>

Chris--

Tough to tell from here, but my first guess would be a bad match in the pi net. (I do not have the circuit and thus can't offer specific suggestions.) You can't always just "lift" a pi net from a circuit and use it with a different final. Usually there's some tweaking to be done. The cherry color on the plate suggests that the plate is dissipating the power that isn't going to the output, and that's usually an impedence match issue.

I am slam-bang sure that any sweep tube ever made is usable for CW on 40m. Sweep tubes usually have gain way out past 807's and are often very tough to tame from a parasitic standpoint. Don't trust your scope, BTW--use a GDO in wavemeter mode.

Is there a bias problem in the final? I had a problem once with a 6417 tube that relied on self-biasing where a coupling cap was open, and there was no

bias on the grid. You don't mention bias anywhere; that's another obvious thing to look at.

Other less likely things to check: A too-small coupling cap from the plate circuit into the pi net. I always test EVERY component I use that's testable; I've run into WAY too many mismarked components in the past 30 years.

I don't think the supply voltage is the problem. Nor is the bleeder resistor, tho for safety's sake you might stick a bigger one in there.

Gotta run but by all means good luck and have at it! We'd all like to hear what the ultimate problem was and how you found it.

--73--

--Jeff Duntemann KG7JF
  Scottsdale, Arizona

Date: Wed, 18 Sep 1996 17:44:36 -0700
From: haynes@cats.ucsc.edu (Jim Haynes)
To: glowbugs@theporch.com
Subject: Re: Advice on tube cutoff frequency
Message-ID: <199609190044.RAA03507@hobbes.UCSC.EDU>

Another thing that might be going on here is that in the old days we talked about transmitters in terms of power input, because that was easy to measure. So maybe the "50 watts" in the article is talking about input, not output.

Date: Wed, 18 Sep 1996 18:00:11 -0700
From: okasb@rex.mtv.gtegsc.com (Bob Okas)
To: glowbugs@theporch.com
Subject: Re: Advice on tube cutoff frequency.
Message-ID: <9609190100.AA04463@rex.mtv.gtegsc.com>

Chris,

    First off, congrats on the new call! I'm not familiar with

the design you're discussing, so my advice can only be general in nature. I'm not familiar with the 6LR8, but it sounds like a miniature 9-pin device (tube books are at home), not an octal or novar type, but I've been wrong before. If it's designed for TV horizontal/vertical sweep service, it should do nicely in a one-tuber.

Let's see, oskillator foist. I'm guessing the triode section is wired as a Pierce oscillator, or perhaps as an electron-coupled oscillator. There are frequency dependent caps in the Pierce circuit, so coupling may be a problem. In general, the electron coupled osc is the most frequency-independent. You might try another 40m xtal to see if the osc produces higher output. It could be your 7.1 MHz rock has low activity and hence, a lower output from the triode section, bad news for a self-biased final.

Is the triode plate circuit tuned? From your description, is sounds like it's not. With a parallel-resonant circuit in series with the plate supply, you can substantially reduce the value of the plate resistance, bypassing the B+ side of the tank to ground via a .01 uf cap. This will present a high-impedance RF load to the triode plate while giving it the most DC juice to work with. Alternatively, hang a 2.2mH choke in series with the triode plate supply. I recommend using pie-wound jobbies. Also, reduce the plate resistance to something on the order of 2-5K. You want the all of RF voltage to appear across the choke an the 98K ohms or so of choke reactance (on 80m) will ensure that. Keep an eye on the triode plate current and keep it within the tube's ratings.

On to the power amp. What are the pentode's rated plate current and dissipation ratings? I suspect they're both less than 75 mA and 10 watts, respectively. What are you using for a plate choke? Can you measure it's inductance? Sorry for asking so many questions, I'm just trying to provide avenues for exploration... Also, determine the final grid current by measuring the key-down voltage across the 27k grid resistor. Keep that within specs or the tube will be short-lived.

As a basis for comparison, the popular 6146 beam power tube has a max control grid current of 3mA. The max plate current is on the order of 125 mA and max plate voltage of around 750V, if memory serves me. That results in a total DC power input of around 90W. A well designed transmitter running a 6146 under those conditions should be squirting around 60-65 RF watts out of the SO-239.

Here's a hypothetical final: Plate voltage is 280V, key-down current is 75 mA. DC power input to the final is 21 watts (neglecting the screen current). Assume an efficiency of 70%. Total RF power output from the tube is then .7 * 21 = 14.7 watts. Sound close to your situation? If so, then you ain't gonna get no more than 15 watts out of that rig, and as I suspected,

the performance claims were far overrated.

Weak output on 40m is probably attributable to the low oscillator output. Remember, the final is generating its own grid bias by rectifying the oscillator signal. Lower drive signal means less negative bias, which leads to more plate current, and the final ain't operating in Class C no more. Hence, the dull red glow on the plate.

A safety measure would be to introduce some fixed negative bias on the final control grid. I'm guessing that around -10 to -20 volts ought to do it. It ain't called protective bias fer nuttin! The fancier tube transmitters have a tube, usually a medium power pentode like a 6AQ5, wired across the final tube screen grid supply. This tube is called a "clamp" and its grid monitors the final control grid current. If there is no RF drive, there's no grid current and the clamp tube conducts heavily, bringing the final's screen grid to nearly ground potential. The net result is that it saves the final from self-destruction.

Since I'm flying blind here and wildly conjecturing, I may be totally off-base with respect to your situation. The suggestions I've provided are what one typically finds in a well designed transmitter. If you need further info, ARRL handbooks from the 60's have numerous tube transmitter circuits that might fill in the gaps.

Hope all of this helps. Let us know what you find.

Bob - N3MBY/6

Date: Wed, 18 Sep 1996 20:18:04 -0700
From: mjsilva@ix.netcom.com (michael silva)
To: glowbugs@theporch.com
Subject: RF Chokes (Homebrew and otherwise)
Message-ID: <199609190318.UAA26331@dfw-ix9.ix.netcom.com>

All this talk about chokes brings up a couple of questions I have about them:

First, does anyone know the typical insulation breakdown rating on magnet wire? I'm wondering about the RF voltage breakdown between any two layers of a back-and-forth winding, should I want to try winding my own.

Secondly, I know chokes have one or more resonances, both series and

parallel. When I look at choke specs they just seem to list one resonant frequency. I've always assumed that frequency that was the (first) parallel resonance -- is that always true? Where -does- the first series resonance "typically" occur relative to the first parallel resonance in an RF choke?

Thanks for any insights.

73,
Mike, KK6GM

Date: Thu, 19 Sep 1996 04:54:56 GMT
From: wrt@eskimo.com (Bill Turner)
To: jeffd@coriolis.com
Cc: Multiple recipients of list <glowbugs@theporch.com>
Subject: Re: Space charge tubes, cheap!
Message-ID: <3240cfd7.4149285@mail.eskimo.com>

On Wed, 18 Sep 1996 10:44:30 -0500 (CDT), you wrote:

>Hi guys--
<snip>
>In the meantime, I'd be curious to hear stories of people who have used 12V
>tubes successfully. I do know the 12AX7 can be used at 12V for things like
>converters; I have articles about that in my files out of CQ and QST. I
>made the 12U7 oscillate at 12V without any trouble. A good, sensitive regen
>detector eluded me--but to be fair I didn't spend a lot of time on it.
>
>--73--
>
>--Jeff Duntemann KG7JF
> Scottsdale, Arizona

My first job after high school (1959) was repairing car radios, and as you said, many of them used tubes designed for 12 volts on the plate and screen. These radios all had a noticeable lack of sensitivity for weak stations compared to conventional high-voltage type radios, but that was due to just taking a standard design and plugging 12 volt tubes into it. They should have added one more stage of RF or IF amplification and they would have been fine. As often happens, Detroit saves a few pennies and the customer suffers.

One interesting thing I remember is that conventional high-voltage tubes worked fairly well in those radios. Many of the pentodes had exact pin-equivalents and could be plugged in with no modifications. They didn't have quite as much gain, but on local stations, worked fine.

Once inexpensive transistors became available, low-voltage tubes became just a footnote to history.

73, Bill W7LZP
wrt@eskimo.com

End of GLOWBUGS Digest 295
****